

Virginia Mercury Advisory Committee



Meeting Agenda Summary

- Opening Remarks
- Meeting Objectives
- DEQ Presentations
 - Overview of fish-tissue monitoring program
 - Mercury concerns and special issues
- Virginia Department of Health presentation
- North Carolina Experience
- Lunch
- Committee discussion
 - Identification of needs for further investigations
 - Plans for additional meetings



Mercury in Fish Tissue from the
Blackwater River, Great Dismal
Swamp Canal, Dragon Run Swamp



FISH TISSUE / SEDIMENT MONITORING

DEQ Fish Tissue Monitoring

- Chemical contaminant analysis to identify health risk to human consumers & potential aquatic ecosystem impairment
- 14 river basins & sub-basins monitored on a 3-5 year rotation
- Normally sample 80 -100 stations per year including follow-up and special studies.



Fish Collected by DEQ are Analyzed for Full Set of Toxic Pollutants

- Used to assess potential health risk to consumers due to:
- Toxic metals, including mercury.
- Pesticides.
- PCBs
- Other toxic chemicals



DEQ Collects Species That Feed on Plants, Insects and Other Fish

- Different types of pollutants can concentrate in fish species differently depending on the fish's diet.
- DEQ samples fish from three trophic levels, with a variety of eating habits.



Sediment also Sampled at Fish Sampling Sites

- Sediment samples taken at same sites.
- Used to assess potential for toxic impacts on benthic community.
- Used for aid in source identification.



DEQ Targets Waterbodies with High Likelihood of Pollution



Virginia Waters Monitored on a Rotation Basis



Rotating Sampling in River Basins Every 3 - 5 Years

- 14 river basins & sub-basins in Virginia
- Approximately 50,000 miles of streams and rivers.



Monitoring Effort Has Increased in Last Few Years

- 13 of the 14 river basins in Virginia monitored between 2000 and 2002.
- Normally sample 80 -100 stations per year, including follow-up and special studies



When Resources are Available, Aim is to Complete Rotation in Three years

- Recent budget cuts and staff reductions means that for the time being, we will be going back to a five year rotation.

Once Collected, Fish are Sorted and Selected for Analysis

- 3 to 5 species from each site
- 5 to 10 individuals for each species
- composites of filets are analyzed
- Fish data represent long-term average concentrations



DEQ's Collected Fish are Analyzed for Toxic Pollutants

- Fish collected by DEQ
May - October
- Fish analyzed at
VIMS and W&M labs
October - June
- Data back to DEQ by
end of June following
year of collection



DEQ Shares Data with Department of Health, Assesses the Data and Posts Data on DEQ Website

- DEQ uses risk-based fish tissue concentrations equivalent to Virginia's Water Quality Criteria to assess the data
- Virginia Department of Health is responsible for issuing Fish Consumption Advisories

Information Placed on DEQ Website Within One Month of Receipt from Lab

- All DEQ fish tissue and sediment data for 1995-2002 are posted on the DEQ website at :
- **www.deq.state.va.us/fishtissue/homepage**

If a Contaminant Concentration
in Fish Tissue Exceeds Level of
Concern, More Intense
Monitoring is Conducted to
Better Characterize the Extent of
the Problem

Fish Tissue Data Used in 305(b) Assessments

- Data reviewed to determine if water body supports “fishable” designated use.
- If fishing use is not supported, the water body placed in the list of impaired waters (303(d) list)



If Fishing Use is not Supported, the Water Body is Placed on a List of Impaired Waters

- These waters require further investigation to determine the cause of the impairment and can result in regulatory action to improve the condition
- A Total Maximum Daily Load (TMDL) needs to be developed and implemented



Fish Tissue Data Supplied by DEQ is Used by Virginia Department of Health in Determining Need for Fish Consumption Advisories

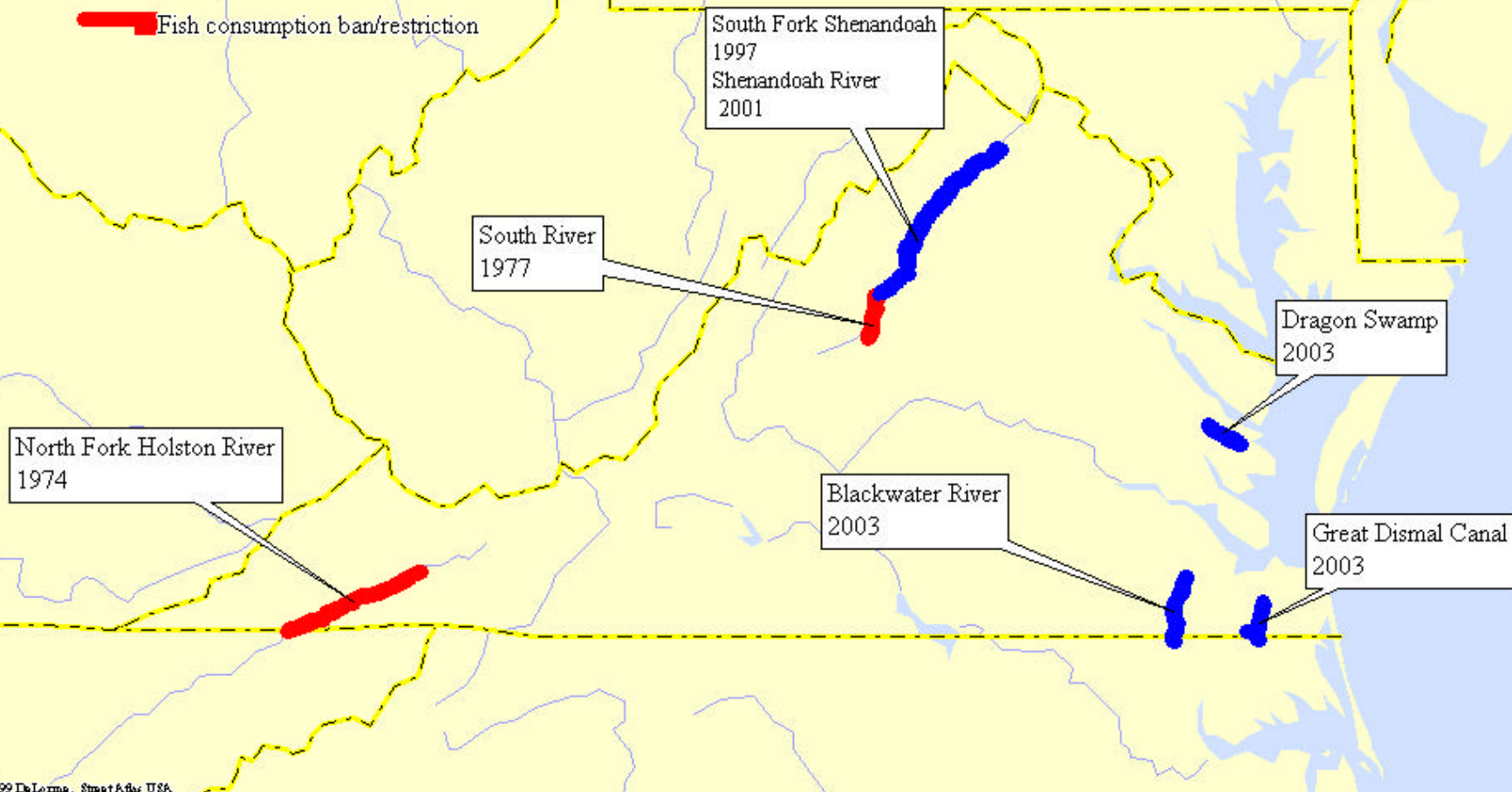
- Currently fish consumption advisories in Virginia include:
- Eleven due to PCBs
- Six due to mercury (three new last year)
- One for kepone

Fish Consumption Advisories are Issued by Department of Health to Advise the Public of Potential Health Risks

- Virginia Department of Health has established a policy of issuing fish consumption advisories when fish samples exceed 0.50 parts per million of total mercury

Fish Consumption Advisories due to Mercury in Virginia

-  Fish consumption advisories
-  Fish consumption ban/restriction



New Fish Consumption
Advisories Causes DEQ to do
Additional Sampling in the
Watershed to Better Characterize
the Extent of the Problem



Mercury

Increasing Interest Nationwide in Mercury in Recent Years

- Mercury is one of the toxic pollutants that is typically seen in fish tissue
- Across the U.S., many fish consumption advisories are due to mercury

Mercury Can Cause Adverse Health Effects

- When ingested in excess quantities mercury can cause neurological impairment.
- Developing fetuses and young children are much more sensitive than adults.
- Most sensitive populations are pregnant women, nursing mothers and young children.

Mercury is a Special Pollutant

- Naturally occurring element
- Human activities can increase the amount of mercury in some situations
- Persistent in the environment
- Present in several chemical forms
- Transformed in the environment into several different chemical forms
- Methylmercury accumulates in fish and concentrations magnifies up the food chain

Two Known Instances of Mercury Pollution in Virginia

- Waynesboro:
- portions of South River, South Fork of Shenandoah and Shenandoah River
- Two fish consumption advisories in effect
- Saltville:
- North Fork of Holston River
- fish consumption advisory (ban) in effect

Nationwide Increasing Concerns
with Mercury and Increasing
Numbers of Fish Consumption
Advisories in Other States
Prompted Additional Review by
DEQ

Level of Concern for Mercury in Fish Tissue was Lowered in 2000

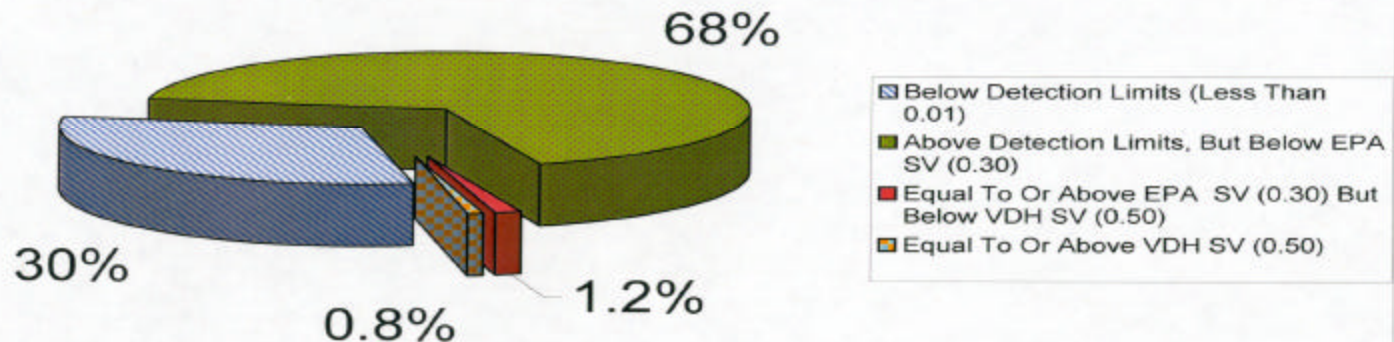
- Prior to late 2000, a level of 1.0 ppm mercury in fish tissue was used as a level that would trigger a fish consumption advisory
- This was based on FDA action level for mercury allowed in commercial seafood
- In October 2000, the Virginia Department of Health revised their guidance concerning mercury in fish tissue and began to use 0.5 ppm as a level of concern
- First used in reviewing data in 2001

DEQ Reviewed Virginia Mercury-Fish Data in 2001

- Reviewed all available 1995-1999 mercury-fish contamination data
- Concluded that except for two known sites of industrial pollution, mercury was rarely seen in our samples at levels of concern

1995-1999 Fish Mercury Concentrations

Mercury Concentrations in Routine Fish Tissue Samples Collected From 1995 to 1999 (Sample Size = 565). The Data Set Does Not Include the Shenandoah & Holston River Special Study Monitoring Data. Concentrations are in ppm, Wet Weight Basis.



Mercury is a Common Pollutant Found in Fish Tissue

- Mercury is a toxic metal
- Mercury is found in all fish at some concentration if detection level is low enough
- Common in seafood

Mercury Bioaccumulates In Fish

- Mercury bioaccumulates in different species to different degrees.
- Top predator species (e.g. largemouth bass, pickerel, bowfin) more likely to contain higher amounts of mercury.

Mercury bioaccumulates in different species to different degrees

- Small, or young fish usually contain low concentrations of mercury.
- Fish that eat plants and insects usually contain lower concentrations of mercury.



Larger Fish Usually Contain Higher Levels of Pollutants

- The degree of contamination depends on:
 - size of the fish,
 - age of the fish
 - and its eating habits.



Highest Levels of Mercury Often Seen in Fish-Eating Species

- Largemouth Bass
- Chain Pickerel
- Bowfin
- Striped Bass



Methylmercury is the Common Form of Mercury Found in Fish Tissue

Approximately 85-95 % of mercury in fish tissue is methylmercury

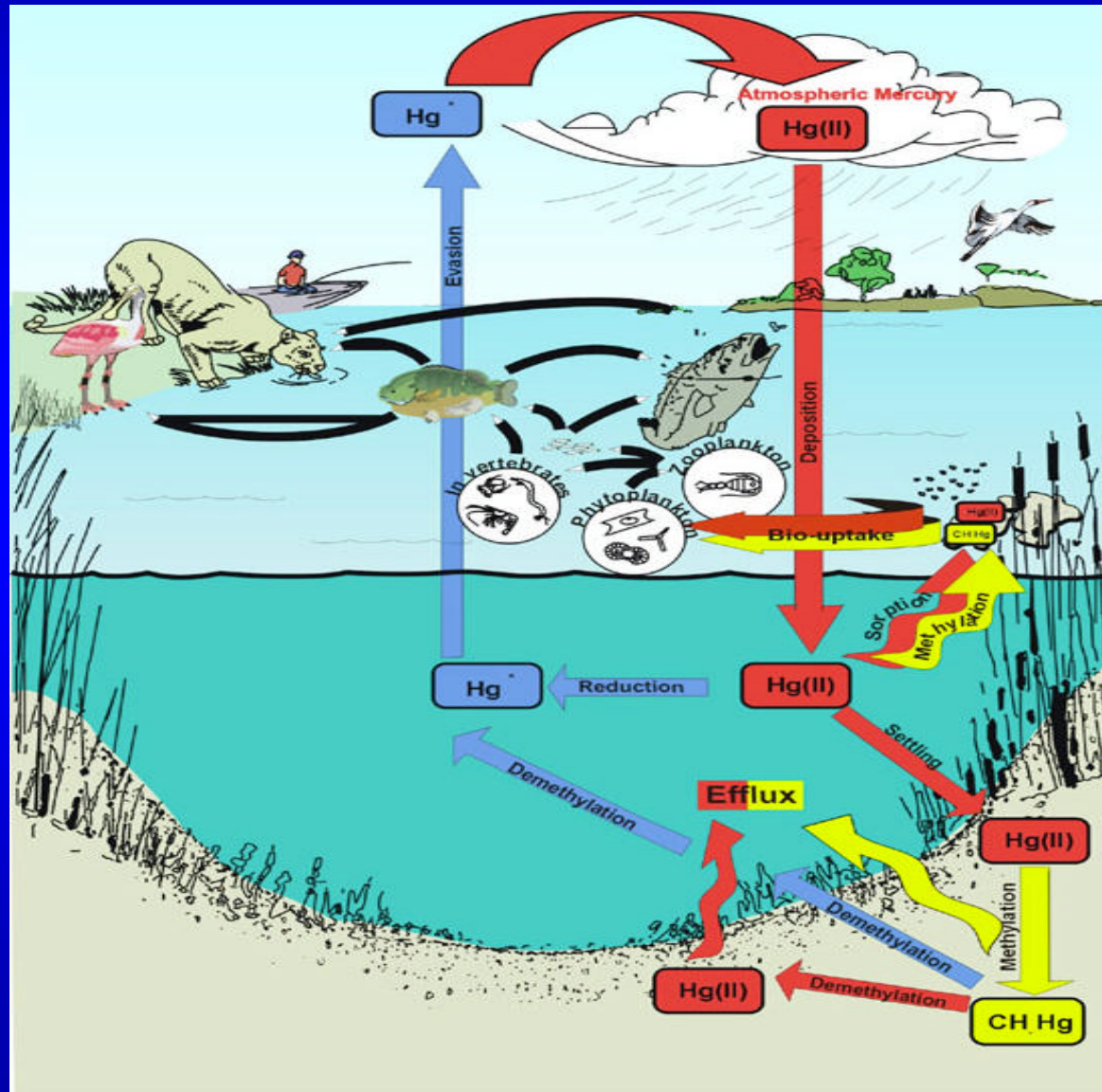
Methylmercury is Produced in the Natural Environment

- Several forms of mercury exist in the environment
- Other forms of mercury are transformed into methylmercury ($\text{CH}_3\text{-Hg}$) by certain bacteria that are present in soil or sediment

Mercury Cycle in Environment is Complex

- Certain environmental conditions favor the formation of methyl mercury
- Methyl mercury is most toxic form of mercury and the form that bioaccumulates in fish

Mercury Cycle



Environmental Conditions That Favor Production of Methyl Mercury

- Methylation rates are highly variable and site specific but some common characteristics are important:
 - acidic waters (low pH)
 - high levels of organic material
 - low levels of dissolved oxygen

Conditions that Favor Mercury Methylation are Common in some Lakes, and especially in Bogs, Swamps and Blackwater Streams

- acidic waters (low pH)
- high levels of organic material
- low levels of dissolved oxygen

Elevated Levels of Mercury in Fish Have Been Seen in Many Places Where There are no Obvious Sources of Mercury

- Canadian Arctic
- Scandinavia
- Minnesota
- Wisconsin
- New England
- Florida Everglades
- North Carolina
- Maryland

Air Deposition of Mercury and Increased Methylation Rates in Sediments are Suspected Causes of Mercury-Fish Contamination in Many of these Areas

- DEQ will ask the Mercury Advisory Committee to investigate this as a potential concern in Virginia

North Carolina Fish Consumption Advisory

- North Carolina has also noted this phenomenon of elevated levels of mercury in fish in the “swampy” waters of the coastal plane.
- fish consumption advisory has been issued for eastern North Carolina for largemouth bass, chain pickerel and bowfin.

This Information Suggests that
Elevated Levels of Mercury are
More Likely in Fish From Lakes
and Areas with “Swamp-like
Conditions”

- DEQ decided to look more carefully in these environments, even if no industry was present.

In 2002 DEQ Monitored Rivers in Southeastern Virginia

- Chowan and Albermarle Sound River Basin
 - Meherin River
 - Nottoway River
 - Blackwater River
 - Dismal Swamp Canal
 - Other small rivers
- Dragon Run Swamp (as a follow-up)

Dragon Run Swamp

(Upstream of Piankatank River)

- Sampled at Route 17 bridge:
- 1998 Largemouth Bass **1.90** ppm mercury
- 2000 Largemouth Bass **0.59** ppm mercury
- 2002 Largemouth Bass 0.047 ppm mercury
- 2002 “ “ 0.090 ppm mercury
- 2002 “ “ 0.10 ppm mercury
- 2002 “ “ **0.57** ppm mercury
- 2002 “ “ **0.71** ppm mercury

Blackwater River

DEQ Sampled Fish in 1996 and 2002

- Mercury not detected in fish samples in 1996.
- However, in the 2002 samples, mercury was above the level of concern in three fish samples.

Some Fish From **Blackwater River** Collected in 2002 Showed Elevated Levels of Mercury

- **River mile 31.90: near Route 603 Bridge:**
 - **Redear sunfish:** **0.64 ppm mercury**
 - **Shorthead Redhorse sucker:** **0.49 ppm mercury**
 - **Chain Pickerel:** **0.15 ppm mercury**
 - **River Mile 22.84: Near Route 611 Bridge:**
 - **Largemouth Bass:** **0.68 ppm mercury**
 - **Bluegill Sunfish:** **0.15 ppm mercury**
 - **Gizzard Shad;** **0.094 ppm mercury**
- **River mile 0.6: downstream of Franklin, about 0.6 mile from confluence with Nottoway River:**
 - **Largemouth bass:** **1.1 ppm mercury**
 - **Redear sunfish :** **0.12 ppm mercury**
 - **Gizzard shad:** **0.029 ppm mercury**

Feeder Ditch off Dismal Swamp

Canal: Two Fish Samples in 2002

Exceeded 0.50 ppm Mercury

- Bowfin 1.5 ppm mercury
- Chain Pickerel 0.78 ppm mercury
- Bluegill Sunfish 0.26 ppm mercury
- Yellow Bullhead Catfish 0.24 ppm mercury

Recent Fish Consumption Advisories Issued by Virginia Department of Health for Mercury

- Advisories Issued in October 2003
- Blackwater River
- Dragon Run Swamp/Piankatank River
- Great Dismal Swamp Canal

Species Affected by Fish Consumption Advisories

- Largemouth Bass
- Redear Sunfish
- Chain Pickerel
- Bowfin



Search for a Source:

Usual Sources of Mercury in the Environment

- Naturally present in some rocks.
- Human caused sources:
 - Chlor-alkali plants (chlorine production)
 - Mining: mercury or gold
 - metals recycling
 - atmospheric deposition from combustion (coal fired plants, municipal waste incineration, medical waste), or volcanoes

No Obvious Source of Mercury in these Watersheds

- DEQ will investigate potential man-made sources
- Environmental conditions in swamps and blackwater streams are known to promote formation of a form of mercury that is more likely to accumulate in fish
- Atmospheric deposition is a possible source of mercury

Coming This Summer;

- Data from 2003 fish monitoring from some additional sites and small lakes where we may expect to see increased methylation of mercury and elevated levels of mercury in fish
- We might anticipate that some of these fish could exceed 0.5 ppm mercury

What is Being Done?

1

- Virginia Department of Health has issued fish consumption advisories for these three waterbodies.

What is Being Done?

2

- DEQ is planning additional fish tissue and sediment sampling this summer:
 - 9 sites in the Blackwater River
 - 7 sites in Dragon Run
 - 8 sites in the Dismal Swamp

What is Being Done?

3

- DEQ will continue to investigate this issue and look for potential sources of mercury in the watershed.
- Plans prepared for source investigation in the Dragon Run Swamp watershed this year.

What is Being Done?

4

- A Mercury Advisory Committee has been formed to help advise DEQ on how to deal with this issue.

Mercury Advisory Committee Formed.

- Representatives of other State and Federal Agencies
- Universities
- Environmental Groups
- Industry
- First meeting April 16, 2004

Three Issues to be Addressed by Mercury Advisory Committee

- **1. Provide advice for DEQ investigation of potential land-based sources of mercury in the watersheds**

Three Issues to be Addressed by Mercury Advisory Committee

- **2. Advice for DEQ investigation of potential for air-born mercury to be a source of the mercury in these watersheds**

Three Issues to be Addressed by Mercury Advisory Committee

- **3. Assist in developing a plan to address the related source assessment and remediation issues**